



**UNIVERSITI PUTRA MALAYSIA**

***NEUROBEHAVIORAL PERFORMANCE OF MALE  
METHAMPHETAMINE-DEPENDENT TRAINEES DURING ABSTINENCE  
IN SELECTED NARCOTIC ADDICTION REHABILITATION CENTRES,  
MALAYSIA***

**DZULKHISSHAM BIN RAHMAT @ RAHAMAN**

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**By**

**DZULKHISSHAM BIN RAHMAT @ RAHAMAN**

**Thesis Submitted to the School of Graduate Studies, Universiti Putra Malaysia,  
in Fulfilment of the Requirement for the Degree of Master of Science**

**May 2012**

## DEDICATION

This thesis is especially dedicated to parents, Hj. Rahmat bin Kemoh and Mariam binti Mahat, my wife, Mahanum binti Daim, my sons and daughters; thanks for their support and inspiration, may the blessing of Allah lay upon them. My special thanks are due to my extraordinary supervisor, Associate Professor Dr. Muhammad Nazrul Hakim bin Abdullah and Professor Dr. Roslan bin Sulaiman for giving me great inspiration and enabling me to complete my master's project. Not forgetting, thanks to Associate Professor Dr. Shamsul Bahari bin Shamsudin, his guidance and dedication will keep inspiring me throughout my life. Last but not least, I would like to express my heartiest appreciation to my friends and all colleagues who were involved in this project.

Abstract of thesis presented to the Senate of Universiti Putra Malaysia in fulfillment of the requirement for the degree of Master of Science

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By

**DZULKHISSHAM BIN RAHMAT @ RAHAMAN**

**May 2012**

**Chairman: Muhammad Nazrul Hakim Bin Abdullah, PhD**

**Faculty: Medicine and Health Sciences**

Methamphetamine (MA) is an illicit psychostimulant drug. Chronic or heavy MA use may induce symptoms resembling paranoid schizophrenia, including delusions, and auditory hallucinations. Excessive use of MA can cause hyperactivity, agitation, and paranoia, and a psychotic state lasting from days to weeks. Methamphetamine abusers not only cope with the negative societal repercussions resulting from abuse, but both the immediate and persistent neurobiological consequences as well. The inexpensive production of MA, its low cost, and long duration of action have made it a very desirable commodity among the drug addict. Methamphetamine can be produce illegally by laboratory with simple instrument needed and experties. Research over the past 10 years has suggested that MA abuse has become a key problem in youth communities. In this study, the Neurobehavioral Core Test Battery (NCTB) was used to evaluate neurobehavioral functions of all tested subjects. This battery included seven sets of tests: Profile of Mood States, Simple Reaction Time,

Digit Symbol, Digit Span, Santa-Ana Test, Benton Test, and Pursuit Aiming II. All subjects were interviewed to collect demographic data and information on general health status, and lifestyle. Respondents were selected based on criteria of inclusive and exclusive, and with their voluntary to participate in this study. The respondents are ex-addicts who were placed in rehabilitation center were in abstinence period, Pusat Pemulihan Penagihan Narkotik (PUSPEN) involved with MA, or who has a history of involvement with MA use. In addition, this study is the only male trainees. In this study, the respondents were divided into seven groups; they are: (1) Normal Group, (2) MA addicts that still not undergo Therapeutic Communities (TC), the groups that have undertaking TC program; there are 4 sub-groups in TC program. They are (3) Red which is first level, (4) Yellow as second level, (5) Green as third level and (6) White is the last level. The group was arranged according to trainee's development in the TC program. The seventh group in this study was the group that consists of PUSPEN trainee that will finish TC program within 2 to 3 weeks. In the study of the Digit Forward Test and Digit Backward Test, there were significant difference ( $p < 0.05$ ) between groups in the Therapeutic Community (White, Green, Yellow and Red). It was showed that, the new trainee (Red) can turn the peg of Santa Ana with same time needed as the trainee that going to finish TC program in the Santa Ana Forward Test. In Santa Ana Backward test, it was showed that there were no significant differences between Yellow, White and Red group. However, Green group showed significant ( $p < 0.05$ ) different with other groups. In the study of the Simple Reaction Test (dominance and non-dominance hand), there were no significant difference between groups in the White, Green, Yellow and Red. This showed that all the groups have same response time. Red Group which is new

trainee in TC program was not significantly difference as compared to White Group (final stage of TC). In the study of the Digit Symbol Test, Benton Visual and Pursuit Aiming Test; there were significant difference ( $p < 0.05$ ) among the 7 groups. These showed that perceptual motor speed, learning of associations, ability to organize geometrical pattern in space, memorizing, ability to make quick and accurate movements of trainee are significantly different among the groups.

These findings were demonstrated that MA abuse is associated with impairments across a range of neurocognitive domains, including attention/psychomotor speed, learning and memory functioning compared to Normal Group. However, changes can be viewed as a trainee in the TC program where significant difference ( $p < 0.05$ ) can be seen between groups of red, yellow, green and white. The most important factor that cause the differences was believed to be abstinence period that underwent by the trainee. Besides that, there are other factors that cause significant difference in the NCTB test such as duration of addiction, amount of MA taken, and frequency of MA taken. However, the factor of age starting addicted not caused significant difference for all tests among the 7 groups.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk ijazah Master Sains

**FUNGSI NEUROBEHAVIORAL DALAM KALANGAN PENAGIH  
METAMFETAMIN LELAKI PADA FASA ABSTINEN DI PUSAT  
PEMULIHAN PENAGIHAN NARKOTIK TERPILIH DI MALAYSIA**

Oleh

**DZULKHISSHAM BIN RAHMAT @ RAHAMAN**

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Metamfetamin (MA) adalah dadah jenis psikostimulan. Pengambilan MA yang kronik boleh menyebabkan gejala skizofrenia paranoid, termasuklah delusi dan halusinasi pendengaran. Penggunaan MA yang berlebihan boleh menyebabkan hiperaktif, tindakan tanpa kawalan, dan paranoia, dan berkeadaan psikotik yang berlangsung dari sehari sampai seminggu. Penagih MA bukan hanya mengalami kesan sosial negatif akibat dari penyalahgunaan, tetapi juga mengalami kesan buruk neurobiologi langsung. Kos pembuatan yang murah, harganya yang rendah, dan tempoh kesan khayal yang panjang menjadikannya sebagai sebuah komoditi yang sangat dikehendaki di kalangan penagih dadah. Metamfetamin dapat dihasilkan secara haram di dalam makmal dengan instrumen dan kemahiran yang minima. Penyelidikan selama 10 tahun terakhir telah menyarankan bahawa penyalahgunaan MA telah menjadi masalah utama di dalam komuniti. Dalam kajian ini, neurobehavioral Core Test Battery (NCTB) telah digunakan untuk menilai fungsi

neurobehavioral dari semua subjek yang diuji. Bateri ini termasuk tujuh set ujian: Profile Mood States, Simple Reaction Time, Digit Symbol, Digit Span, Santa-Ana Test, Benton Test, dan Pursuit Aimimng II. Semua subjek ditemuduga untuk mengumpul data demografi dan maklumat mengenai status kesihatan dan gaya hidup. Responden dipilih berdasarkan kriteria inklusif dan eksklusif dan dengan persetujuan mereka untuk menyertai dalam kajian ini. Responden adalah bekas penagih yang ditempatkan di pusat pemulihan dalam tempoh pantang dan pernah menggunakan MA. Selain itu, peserta kajian ini adalah kesemuanya peserta lelaki sahaja. Dalam kajian ini, responden yang terlibat dibahagikan kepada tujuh kumpulan; iaitu Kumpulan Normal, Kumpulan penagih MA yang belum menjalani Terapi Masyarakat (TC), Kumpulan yang sedang menjalani TC yang terdiri daripada 4 sub-kumpulan. Mereka adalah Merah yang peringkat pertama, Kuning peringkat kedua, Hijau sebagai peringkat ketiga dan Putih adalah tahap terakhir. Kumpulan ini ditetapkan sesuai dengan perkembangan peserta latihan dalam program TC. Kumpulan yang ketujuh ialah terdiri daripada individu-individu yang hanya tinggal dua ke tiga minggu untuk meninggalkan PUSPEN. Dalam kajian Digit Forward Test dan Digit Backward Test, terdapat perbezaan nyata ( $p < 0.05$ ) antara kelompok di TC (Putih, Hijau, Kuning dan Merah). Hal ini menunjukkan bahawa, para pelatih baru (Merah) dapat menukar kiub Santa Ana dengan waktu yang sama diperlukan oleh pelatih yang akan menyelesaikan program TC di Santa Ana Forward Test. Ujian Santa Ana uji Backward menunjukkan bahawa tidak ada perbezaan yang signifikan antara sub kumpulan Kuning, Merah, dan Putih. Namun, sub kumpulan Hijau mempunyai perbezaan yang nyata ( $p < 0.05$ ) dengan kumpulan lain. Dalam kajian Simple Reaction Test (tangan dominan dan tangan tidak dominan), tiada perbezaan



yang signifikan antara kumpulan Putih, Hijau, Kuning dan Merah. Dapatan ini menunjukkan bahawa semua kumpulan mempunyai masa tindak balas yang hampir sama manakala, ujian Digit Symbol Test, Benton Visual dan Pursuit Aiming Test pula; terdapat perbezaan yang signifikan ( $p < 0.05$ ) antara 7 kumpulan tersebut, ini menunjukkan bahawa kelajuan motor persepsi, kebolehan mengaitkan, kemampuan untuk menetapkan pola geometri dalam ruangan, menghafal, kemampuan untuk melakukan gerakan cepat dan tepat, mempunyai perbezaan yang sangat signifikan dibandingkan antara semua kumpulan-kumpulan yang dibandingkan.

Penemuan ini menunjukkan bahawa penyalahgunaan MA adalah berkaitan dengan gangguan pada pelbagai domain neuro-tingkahlaku dibandingkan dengan Kumpulan Normal. Namun, perubahan ketara boleh dilihat pada pelatih di mana perbezaan ( $p < 0.05$ ) yang signifikan dapat dilihat antara kumpulan merah, kuning, hijau, putih dan kumpulan yang akan menghabiskan program TC. Salah satu faktor yang besar dalam perbezaan ini adalah dipercayai kerana tempoh abstinen yang dilalui oleh setiap sub kumpulan tersebut. Selain itu terdapat juga faktor lain yang menyebabkan perbezaan tersebut antaranya tempoh menagih, jumlah MA yang diambil, dan kekerapan menggunakan MA, walau bagaimanapun, faktor umur mula menagih tidak menyebabkan perbezaan yang ketara pada hasil ujian dalam 7 kumpulan-kumpulan tersebut.

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I certify that an Examination Committee has met on 21 May 2012 to conduct the final examination of Dzulkhishsham bin Rahmat @ Rahaman on his Master thesis entitle Neurobehavioral Performance of Male Methamphetamine-Dependence Trainees During Abstinence in Selected Narcotic Addiction Rehabilitation Centres, Malaysia accordance with Universiti Pertanian Malaysia (Higher Degree) Act 1980 and Universiti Pertanian Malaysia (Higher Degree) Regulation 1981. The Committee recommends that the student be awarded the Master of Science.

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## **DECLARATION**

I declare that the thesis is my original work except for quotations and citations which have been duly acknowledged. I also declare that it has not been previously and is not concurrently submitted for any other degree at Universiti Putra Malaysia or any other institutions.

---

**DZULKHISSHAM BIN RAHMAT @ RAHAMAN**

Date: 21 Mei 2012

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## LIST OF ABBREVIATION

%	:	percent
<	:	less than
=	:	equal to
>	:	more than
±	:	approximately or about
AADK	:	Agensi Antidadah Kebangsaan
CVD	:	Cardiovascular disease
DAT	:	Dopamine transporter
DNA	:	deoxyribonucleic acid
g	:	gram
HIV	:	Human immunodeficiency virus
κ	:	Kappa
L	:	liter
MA	:	Methamphetamine
Mg	:	miligram
Min	:	minute
ml	:	militer
mM	:	milimolar
NCTB	:	Neurobehavioral Core Test Battery
p	:	probability
PDRM	:	Polis Di Raja Malaysia
POMS	:	Profile of Mood States test
PUSPEN	:	Pusat Pemulihan Penagihan Narkotik
RM	:	Ringgit Malaysia
TC	:	Therapeutic community
UNDCP	:	International Drug Control Programme United Nations
UNICEF	:	United Nations Children's Fund
WHO	:	World Health Organization

## CHAPTER I

### INTRODUCTION

Methamphetamine (MA) addiction has major health and safety consequences in Malaysia. According to United Nations Office on Drugs and Crime (2007), during the last decade, Southeast Asia and East Asia have become global hubs for MA production and trafficking. According to National Anti-Drug Agency (AADK), the case of MA addiction among the Malaysia residence was increased (AADK, 2009). Research over the past 10 years has suggested that MA abuse has become a key problem in youth communities especially in rural area in this country (AADK, 2009). Sabah is one from 14 states in Malaysia that facing this spreading MA addiction with a coincident epidemic of psychostimulant abuse around that area including south Philippines and Kalimantan, Indonesia (Bobby, 2008).

The inexpensive production of MA, its low cost, and long duration of action have made it a very desirable commodity among the drug addict (Louisa *et al.*, 2010). Methamphetamine can be produce illegally by laboratory with simple instrument and expertise needed (David *et al.*, 2012). Unfortunately, the profile of the typical MA abusing individual has increased popularity among rural residences, high school students, women, and young professionals in this country (Maw *et al.*, 2010).

Methamphetamine is an illicit psychostimulant drug (Irina and Jean, 2009). It is also known as methylamphetamine, N-methylamphetamine, and desoxyephedrine (David *et*

*al.*, 2012). It was introduced in the 1930s as a bronchodilator for the treatment of nasal and bronchial congestion associated with colds (David *et al.*, 2012). Chronic or heavy MA use may induce symptoms resembling paranoid schizophrenia, including delusions, ideas of reference, and auditory hallucinations (Joanna *et al.*, 2008). According to Beebe and Walley (1995), excessive use of MA can cause hyperactivity, agitation, and paranoia, and a psychotic state lasting from days to weeks. Furthermore, MA also can cause other complications such as hyperthermia, seizures, hypertension, and cardiotoxicity (Mark *et al.*, 2009). McCann *et al.*, (1998) reported that chronic MA abusers present of neurotoxicity for example decreased dopamine transporter density. They also facing a brief period of abstinence, the decrease in dopamine transporters correlate with a decrease in cognitive function (Volkow *et al.*, 2001) and this consequences is persist even when dopamine transporter levels recover as reported by Volkow *et al.*, (2001).

Methamphetamine abusers not only cope with the negative societal repercussions resulting from abuse, but both the immediate and persistent neurobiological consequences as well (Mark *et al.*, 2009). several reports have demonstrated that the exposure of animals to a neurotoxic MA regimen results in long-term impairment of memory and learning tasks abusers demonstrate general impairment across several neurocognitive domains, including deficits in executive function and memory (Jing *et al.*, 2004).

Drug abuser such as MA addicts in the rehabilitation process will undergo abstinence process. Abstinence is a restriction from taking drug where discontinuation of drug by

the drug addict occurs. According act of the rehabilitation of drug addicts (treatment and rehabilitation) (1983), addicts that were sentenced and ordered by the court to undergo rehabilitation, while undergoing the program they are prohibited from taking the drug until released. This period is called abstinence. The Act clarifies that a drug addict will be charged to undergo treatment after discovered by a medical practitioner that they are addicts.

In this study, the Neurobehavioral Core Test Battery (NCTB) was used to evaluate neurobehavioral functions during abstinence period of all tested addicts. This test was recommended by World Health Organisation (WHO). Neurobehavioral Core Test Battery was validated and widely used in the field of neurobehavioral study. This battery included seven sets of tests: Profile of Mood States, Simple Reaction Time, Digit Symbol, Digit Span, Santa-Ana Test, Benton Test, and Pursuit Aiming II (Chen *et al.*, 2005). All subjects were interviewed to collect demographic data and information on general health status, and lifestyle.

### **1.1 GENERAL OBJECTIVE**

To study neurobehavioral performances among methamphetamine male trainees and its association with age level of taking drug, period of addictions, amount of drugs use, frequency of drugs use and duration of taking drugs in selected PUSPEN during abstinence period.



## 1.2 SPECIFIC OBJECTIVE

1. To identify profile backgrounds among MA dependence on socio-economic status, academic status and family backgrounds.
2. To compare the deference of Neurobehavioral performances score between Non-treated group (NTG), Groups in TC program which are white group (WG), green group (GG), yellow group (YG) and red group (RG) and 2-3 week to finish TC group (FTCG) with normal people.
3. To study association between Neurobehavioral performances score and abstinence period.
4. To study association between Neurobehavioral performances score and age level of taking drug, period of addictions, amount of drugs use, frequency of drugs use and duration of taking drugs.

### 1.3 HYPOTHESIS

1. The Non-treated group (NTG) showed significantly poorer performance than normal control group (NCG) on measures of simple motor function, short-term memory, eye-hand coordination, measures of affective behavior, measures of psychomotor perception and speed.
2. Groups in TC program which are white group (WG), green group (GG), yellow group (YG) and red group (RG) showed not significantly different compared to the normal control group (NCG) on measures of simple motor function, short-term memory, eye-hand coordination, measures of affective behavior, measures of psychomotor perception and speed.
3. The trainees which are almost completed TC program, 2-3 week to finish TC group (FTCG) showed not significantly different compared to the normal control group (NCG) on measures of simple motor function, short-term memory, eye-hand coordination, measures of affective behavior, measures of psychomotor perception and speed.
4. There are significant associations between Neurobehavioral performances score with abstinence period, age level of taking drug, period of addictions, amount of drugs use, and frequency of drugs use and duration of taking drugs.

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